Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

# CONSTANT AND VARIABLE RAILROAD EXPENDITURES AND THE DISTANCE TARIFF.

IN most discussions of railroad expenditures a distinction is made between "constant," "fixed," "general," "common account," or "joint" expenditures, on the one hand, and "special," "variable," or "additional" expenditures, on the other. It is the purpose of the present paper to point out some confusion of thought commonly met with in these discussions, and then to apply the distinction between constant and variable expenditures to the problem of the distance tariff.

Two related distinctions are frequently not clearly separated. The distinction between general and special expenses is not identical with the distinction between constant and variable expenses. The former refers to the familiar fact, which need not be elaborated here, that all of a railroad's expenses cannot be traced to particular units of the traffic. The latter refers to the fact that some expenses grow and others do not grow as the traffic grows. But both distinctions are vague when stated in this general form. The content of the terms "general" and "special" varies with the unit of the traffic taken for the basis of distribution. Practically, no expenses can be traced to a particular shipment. Some can be traced to large classes of traffic, such as the coal traffic, or to separate trains; and still more can be traced to the freight traffic as a whole; and, finally, some cannot be traced at all. Again, the proportion of expenditures to be considered constant is indefinite until a period of time is specified. Some expenditures that remain constant for a year will be found to have varied in the course of a decade. This will be explained more fully presently. However, while these two distinctions are not identical, they are nevertheless related. Expenses that can be traced to particular shipments are clearly variable when even the shortest period of time is under consideration; but expenditures that can be traced to large units of the traffic only, may remain constant for a long period of time, such as the expense of maintaining a freight station. Again, expenses that clearly cannot be traced to either the freight or passenger traffic do nevertheless grow on account of the traffic when the period of time under consideration is long enough, as when a second track becomes necessary.

In the theory of railroad rates it is the distinction between constant and variable expenses that is of first importance rather than that between general and special expenses.[1] The fact that practically no expense can be specifically traced to a box of soap is by no means proof that expenses can be practically ignored in making rates on soap. But, if it can be shown that this box of soap directly or indirectly is the cause of a growth in expenses, then such growth in expense must be attributed to it if we wish to observe the fundamental economic principle of a maximum return for a given effort. If a commodity cannot bear the expense which is causally attributable to it, it is not worth carrying. Variable expenses, being caused by a growth in traffic, must be attributed to specific shipments by averages where they cannot be specifically traced.

This requires somewhat closer examination. As has just been stated, the meaning of the distinction between constant and variable expenditures depends upon the length of time under consideration. Some expenses grow by jerks.[1] Let us take the case of a small railroad with one locomotive which is now hauling five cars daily. The manager might say five additional cars would add but slightly to the total expense, and he could take them at a rate which little more than covered the extra labor, fuel, etc. If he continued this process, he would soon reach the limit of that locomotive and be compelled to add another. The capacity of this second one would now be only partly utilized, and more cars could again be taken at a slightly additional expense until this second locomotive was taxed to its capacity. As a matter of fact, each car of additional traffic was equally responsible for the second locomotive, only the additional expense was temporarily disguised. A steady growth in traffic will result in a jerky but nevertheless inevitable growth in locomotive expense. In a longer period the same thing would hold for other expenditures, such as maintenance of way and structures, which are usually given as typical of the constant class. For the time being more trains can be run without apparent increase in the expenditure on the maintenance of way and structures, but, if the traffic keeps on growing, the line and terminals will become congested; that is, the pressure of diminishing returns will be severely felt, and new track or buildings must be added.

---

[1] Compare Taussig, *Quarterly Journal of Economics*, vol. v. pp. 448–449; and Acworth, *Elements of Railway Economics*, p. 50; and A. v. d. Leyen, *Archiv für Eisenbahnwesen*, 1905, p. 762.

This congestion may not be looked upon as something concerning only the dim future. President J. J. Hill is reported to have said recently:—

> The traffic increases wonderfully, but the railroad facilities have not been able to keep up the pace. This is why to-day your business in some respects is paralyzed, while you cry aloud for transportation help. Long paralysis means slow death. The fact is, probably 40 per cent. of your business to-day is without any facilities with which to handle it.[2]

---

[1] *Cf.* Sax, *Die Verkehrsmittel in Volks u. Staatswirtschaft,* 2 vols., Vienna, 1878–79, vol. ii. p. 365.

[2] *Railway Age,* November 16, 1906.

The following quotations from a recent railroad report[1] illustrate the point specifically:—

> The tonnage shows an exceptional increase both in volume and mileage over that of 1904, the traffic for the year being much the heaviest in the history of the company, and, by reason of the liberal expenditures recently made in the construction of relief lines and large terminal yards and the substantial additions made to your motive power, the movement thereof has been materially improved.
>
> One of the most important matters which received attention during the past year was the providing of a sufficient water supply for present and future needs. Owing to the largely increased demand arising from the growth of the traffic, the former sources of supply had become inadequate. . . .
>
> The expenditures for the current year will include the extension of the four-track system on the Middle and Pittsburgh Divisions, and the necessary revision of the alignment and grades connected therewith. . . . This will, however, not obviate the necessity for the construction of additional relief lines for the Pittsburgh and New York Divisions. As already stated, the low-grade freight line between York Haven and Glenloch will be placed in service in a few months. . . . Another double track relief line is in operation . . . on the Middle Division. These two lines will amply provide not only for the prompt movement of the present traffic between the points named, but for a large increase, but it will be necessary to proceed at once with the construction of an additional freight line about fifty miles long between Morrisville and Newark. . . .
>
> The necessity for the prompt construction of these relief lines will be apparent when it is stated that the average daily movement of freight cars over the Allegheny Mountain summit for October, November, and December, 1905, and January, 1906, was 5,669 cars, with a maximum movement in twenty-four hours of 6,974 cars.

In a recent case before the Interstate Commerce Commission the Pennsylvania Railroad gave as its reason for refusing to join with the Enterprise Company in through rates that "its facilities are so congested in New York at the present time that it is only with great difficulty that it can handle the traffic now offered at that point."[1] An official of the Southern Pacific Company testifies,[2]—

---

[1] Fifty-ninth Annual Report, Pennsylvania Railroad Company, 1905.

> The expenses have also been affected through the railroads having to handle much larger increases in traffic than they were prepared to do with existing facilities; and, although money has been freely spent to increase them, the result has been congested terminals and shops, as well as inability to make repairs on locomotives and equipment when necessary.

In the United States between 1894 and 1904 the second track mileage, yard track, and sidings increased 50 per cent. as against a 20 per cent. increase in the single track mileage.

A traffic manager, eager to get business from his rivals, might easily ignore these long-time variations, and it is possible that this would result in carrying an amount of tonnage which is not worth carrying, even though each charge covered the apparent "additional expenses." Take the following hypothetical case: Imagine a road that has just reached the point of congestion, and that rates are so adjusted as merely to cover the expenditures. Assume two kinds of traffic, the low-grade traffic making two-thirds of the tonnage and yielding one-third of the receipts, and the high-grade making one-third of the traffic and yielding two-thirds of the receipts, as follows:—

| | *Ton-miles.* | *Rate.* | *Revenue.* |
|---|---|---|---|
| Low grade . . . . . . . | 8,000,000 | 0.5 cents | $40,000 |
| High grade . . . . . . . | 4,000,000 | 2.0 cents | 80,000 |
| | 12,000,000 | | $120,000 |

Then assume that a parallel road is added, and that the same conditions throughout are repeated. Now if capital invested were perfectly fluid, and if no vested interests had been built up, it would pay to abandon one of these roads and not to transport a large part of the low-grade tonnage; for, according to hypothesis, taking the two lines together, the low-grade traffic (16,000,000 ton-miles) is more than sufficient to congest one of them and would yield only two-thirds of the necessary expenses ($80,000 instead of $120,000), while the high-grade traffic by itself could be carried on one road with a reduction in rates.[1] This characteristic of railroad expenditures may be exemplified in many other directions. If a book-shelf is half filled, a few additional books will add nothing for the time being to the expense for shelves; but eventually a new case must be added. Again, a bank can add a few more accounts without increase in expense, but the time may come when its lobby is so crowded that it must provide additional room. An electric lighting company will

---

[1] 11 Interstate Commerce Commission Reports, p. 592.

[2] Hearings, 1904–05, Senate Committee on Interstate Commerce, vol. iv. p. 3107.

---

[1] In the United States statistics are not published showing what proportion of the total receipts is derived from each class of the traffic. On this point the Interstate Commerce Commission says: "We have also recently required carriers to furnish statistics showing rate per ton-mile actually received for the movement of certain kinds of carload traffic, but this requirement has not been generally complied with. At a conference with railway officials, when the advisability of requiring these returns was under consideration, it appeared that the carriers objected partly on the ground of expense in keeping the necessary statistics, but also for the reason that, if the public knew the rates actually received for the transportation of these commodities, it would have a tendency to create discontent with the rates" (Annual Report, 1905, p. 11). The following figures from Prussian railroad statistics may be of interest in this connection:—

TRAFFIC AND RECEIPTS, PRUSSIAN-HESSIAN RAILROADS, 1904.
[From *Archiv für Eisenbahnwesen*, April, 1906, pp. 357–358.]

| Not including Company and Government Traffic. | Per cent. of Ton-mileage. | Per cent. of Revenue. | Average Revenue in Pfennigs per Tonnenkilometer.* |
|---|---|---|---|
| I. Normal tariff: | | | |
| Fast freight and express | 0.9 | 4.17 | 16.42 |
| Piece-goods | 3.6 | 11.15 | 11.01 |
| Special piece-goods | 1.3 | 3.23 | 9.06 |
| Carload | 30.3 | 35.08 | 5.02† |
| II. Exceptions-tariff | 63.9 | 46.37 | 2.59 |
| | 100.0 | 100.00 | 3.57 |

* One Pfennig per Tonnenkilometer=.347 cents per ton-mile.

† From 7.51 to 3.08, there being seven classes.

crowd more and more dynamos into its present building, but eventually finds a larger one must be constructed. In all of these cases the question whether an additional service costs much or little depends entirely upon the length of time under consideration.[1]

The ignoring of long-time variations in expenditure is illustrated in the following statement of the considerations which led the Union Pacific Company to make a low rate on certain transcontinental traffic:—

> Now the question arose as to whether we might not better try to carry some of this freight at a cent and a half a pound rather than to continue without a share in the business. Bear in mind the fact that we had very large fixed expenses which it was necessary to meet. First of all there was a large amount to be paid each year for interest on the bonds. This interest was just the same whether we carried a million carloads of freight or carried none at all. Taking a thousand carloads of new business did not increase the interest that was to be paid by $1. Then upon a thousand miles of road we had a thousand men at work to keep up the road-bed, replacing the earth that was washed away by the rains and blown away by the winds, and, in general, seeing that the road-bed was kept in repair, that decaying ties were replaced by new ones, and so on. Then we had a hundred stations at each of which there was at least one man and usually several men. We had a general office to maintain and general officers and a clerical force to be paid

---

[1] From the purely theoretical standpoint this view of railroad expenditures involves a partial denial of the validity of the analogy which Professor F. W. Taussig has drawn (*Quarterly Journal of Economics*, vol. v. p. 443) between the production of various classes of railroad services and the joint production of such commodities as gas and coke, altho in practice the objection may not be of much importance. Gas and coke are produced jointly in the sense that one cannot be produced without the other, and, no matter how large the production becomes, both will continue to be produced jointly. The coke can never be turned into gas. The production of coke does not, in the long run, interfere with the production of gas. It is otherwise in the railroad business. For a long time the passenger service may seem a by-product, and so long the analogy referred to holds; but if we imagine a sufficient growth in the traffic, so that the line becomes congested, it is apparent that the existence of the passenger traffic prevents the running of more freight trains on that line. Then, whether the freight business and passenger business are conducted on separate tracks or whether new tracks are added carrying both freight and passenger trains, neither service can be looked upon as a by-product of the other. It must be admitted, however, that in some parts of the country it may take half a century to congest a single track.

> reasonable salaries. All these expenses and many others remained a constant quantity, which was but very slightly affected by taking some new business. We were obliged to send out a freight train each way every day, even though it might have but very little to carry. It cost us no more to add other cars to the train up to the limit that the engine could haul, and the difference between the cost of hauling a loaded car and an empty one is hardly perceptible.[1]

Is the rotting of the ties a constant expense? Considering that the rotting of the ties now laid will go on, whether we reduce the traffic by one-half or not, it would seem necessary to make an affirmative answer. But the fact that an expenditure once incurred cannot be put to another use should not blind us to the fact that but for the prospect of the increased traffic some of the ties would not have been laid; namely, those under the second, third, or fourth tracks. The question is not, What expenditures would disappear if a certain proportion of the traffic should be discontinued;[2] but, What expenditures would not now be incurred if that traffic had never been called forth? assuming at the same time that the most efficient appliances had been acquired. Is the replacement of antiquated locomotives not yet worn out a constant expense?[3] Certainly it is, if the traffic does not reach the capacity of one locomotive; but where the traffic grows, so that one locomotive after another must be added, we cannot say that locomotive expenses are independent of the traffic.

It thus appears that the expenditures that in the long run increase on account of the traffic are more important than one might suppose from an attempt to distribute the expenditures of any one year to specific shipments.[4] It will be of interest to compare with this theoretical conclusion the actual growth of railroad expenditures in the United States. The following table shows the growth of traffic and expenditure for a period of ten years, the actual amounts having been reduced to index numbers with 1895 as a base:—

---

[1] Hearings, 1904–05, Senate Committee on Interstate Commerce, vol. ii. p. 1685.

[2] Compare Acworth, *Elements of Railway Economics*, p. 35.

[3] *Ibid.*, p. 38.

[4] Interest charges are commonly regarded as constant, but they should be considered variable to the same degree as is the maintenance of the concrete capital goods which were purchased with the capital outlay.

| | Ton-miles. | Passenger Miles. | Maintenance of Way and Structures. | Maintenance of Equipment. | Conducting Transportation. | General Expenses. |
|---|---|---|---|---|---|---|
| 1895 . . . . . . | 100 | 100 | 100 | 100 | 100 | 100 |
| 1896 . . . . . . | 111.8 | 107 | 111.2 | 117.9 | 103.1 | 99.4 |
| 1897 . . . . . . | 111.6 | 100.5 | 108.5 | 106.4 | 99.8 | 98.4 |
| 1898 . . . . . . | 133.8 | 109.7 | 120.4 | 124.9 | 109.1 | 101.1 |
| 1899 . . . . . . | 145.1 | 119.7 | 126.8 | 134.6 | 115.6 | 110.0 |
| 1900 . . . . . . | 166.1 | 131.5 | 150.4 | 164.2 | 126.9 | 112.7 |
| 1901 . . . . . . | 172.5 | 142.3 | 164.6 | 173.2 | 135.5 | 121.8 |
| 1902 . . . . . . | 184.5 | 161.5 | 185.2 | 200.2 | 151.7 | 131.4 |
| 1903 . . . . . . | 203.2 | 171.6 | 198.6 | 225.6 | 174.7 | 142.1 |
| 1904 . . . . . . | 204 | 179.8 | 194.8 | 250.7 | 188.6 | 153.5 |

Maintenance of equipment increased most rapidly, and after 1900 even more rapidly than the ton mileage. Maintenance of way and structures increased less rapidly than the ton-mileage, but more rapidly than conducting transportation, which is usually looked upon as a variable expense. General expenses increased most slowly of all. In interpreting these figures, it is necessary to bear in mind that in a period of prosperity much renewing is done that was neglected in a period of depression, and that much new construction is charged to operating expenses. If in the above table the amount per mile had been taken as a basis instead of the total expenditure of each class, there would have been no important difference in the result. So far as the figures go, they show a rapid increase in all the important lines of expenditure.

It is not to be supposed, however, that the ordinary distinction between constant and variable expenditures is without merit. The following table shows that, as a rule, the per cent. which maintenance of way and structures is of the total expense is greater in regions of light traffic, altho some doubt is thrown on the rule by a comparison of Groups III. and VI., I. and II., VII. and VIII., and IX. and X.

TRAFFIC DENSITY AND RELATIVE IMPORTANCE OF EXPENDITURES FOR MAINTENANCE OF WAY AND STRUCTURES, RAILROAD OF UNITED STATES, 1904.

| Territorial Group. | Per Mile of Line. | | Per cent. Maintenance of Way and Structure is of | |
|---|---|---|---|---|
| | Ton-miles. Thousands. | Passenger Miles. Thousands. | Operating Expense. | Total Expense. |
| I. . . . . . . . | 628.7 | 286.5 | 16.48 | 12.79 |
| II. . . . . . . . | 2,059.1 | 246.5 | 17.35 | 12.32 |
| III. . . . . . . . | 1,379.7 | 120.5 | 19.12 | 14.69 |
| IV. . . . . . . . | 710.4 | 57.4 | 19.37 | 13.80 |
| V. . . . . . . . | 554.1 | 59.9 | 21.83 | 16.33 |
| VI. . . . . . . . | 681.0 | 80.8 | 19.81 | 14.83 |
| VII. . . . . . . . | 542.1 | 66.9 | 23.52 | 16.66 |
| VIII. . . . . . . . | 444.8 | 56.4 | 20.92 | 15.04 |
| IX. . . . . . . . | 397.1 | 49.1 | 20.09 | 14.95 |
| X. . . . . . . . | 533.9 | 111.9 | 23.10 | 14.00 |

Suppose, then, we had determined the per cent. of the expenditures of a particular railroad which at present are to be considered variable and the per cent. to be considered constant.[1] What is to be done with them?[2] By definition the variable expenses are those that are caused by a growth in the traffic, and hence every item which contributes to that growth ought to share in the variable expenses, not as a matter of fairness or justice, but as a necessary consequence of our endeavor to avoid waste. If a commodity cannot bear its share in the variable expenses, it is not worth moving. In determining this share of the variable expenses, it would be necessary to classify traffic with reference solely to the difficulty of handling and hauling it; that is, with reference to bulk, weight, risk, etc. In short, the "natural" system, exemplified in the early history of German railroads, while not valid so far as the total expenses are concerned, is sound so far as the variable expenses are concerned. Why an attempt to impose an average of all expenses on each unit of the traffic would be unwise has been so frequently explained that it need not be discussed here. There is, however, one condition under which an average of all costs would indicate the minimum charge to be made in any case, and that is when a road of such size that it can use the most efficient methods and appliances is on the point of congestion. A simple illustration will make this point clear. Suppose that a book shelf having a capacity of one hundred books costs $5. When the shelf is half filled, the average cost is ten cents per book, but that would not be the cost of keeping books in the long run. The true cost—the cost in the long run—is found by noting the average cost when a shelf is congested; that is, five cents. For temporary purposes it would of course be possible to go below such a minimum, as when getting a back load for cars that would otherwise go empty.

---

[1] An expenditure that grows less rapidly than the traffic may be looked upon as composed of two parts, one absolutely constant and the other varying with the traffic. Thus, if a threefold increase in the traffic causes expenses to increase from $x$ to $2x$, we may assume that half the expenses remained absolutely constant and half increased with the traffic, since $\frac{x}{2} + \frac{3x}{2} = 2x$.

[2] The discussion which follows assumes that competition between railroads has been eliminated.

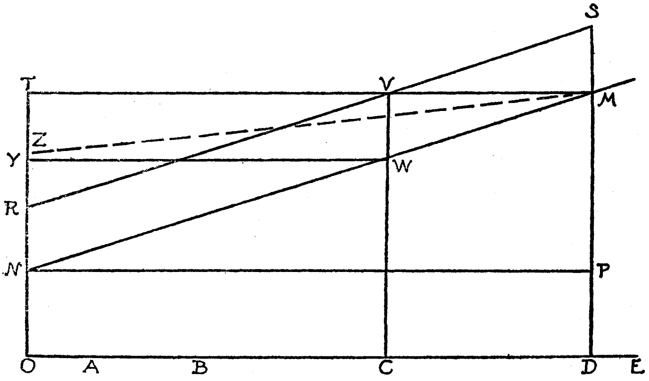
Since the constant expenditures are by definition independent of the volume of the business, they may be distributed without reference to the expense of handling the separate classes of traffic, so that charging what the traffic will bear (when total earnings have been limited) is justified from the social standpoint. Indeed, that policy is imperative, if we wish to have a maximum production of wealth. But how can one determine what the traffic can bear? It is at this point that considerations of justice or fairness enter into the problem of rate-making. As between different classes of commodities, the value principle, altho not entirely satisfactory theoretically,[1] is simple and sanctioned by custom as an indication of what the traffic will bear; but, in distributing constant expenses between freight and passenger traffic, the value principle fails completely. If it is thought desirable to stimulate social intercourse by low fares, the passenger department might, without violating economic principles, be relieved of all contributions to the constant expenditures. To the railroad owners this would, of course, be a matter of indifference if railroad earnings were regulated efficiently. Another way of developing a maximum passenger traffic without increasing the burden of constant expense borne by the freight traffic would be to introduce greater classification in the passenger service, so that the constant expenses would be borne by the richer passengers.

In the distribution of constant expenses between localities the value principle also fails. This brings us to the much-debated subject of a distance tariff. This term, it may be noted, does not necessarily imply equal mileage rates; that is, that the total rate shall always be proportional to the distance. The charge per ton-mile may grow less as the distance increases. The most obvious consideration in favor of the application of some sort of distance tariff is that it appears to be an application of the principle that each commodity shall bear the expenses that can be attributed to it. It seems to be reasonable to say that, the further a thing is carried, the more expense it causes, and

[1] Some valuable articles may need special rates, as much as cheap commodities do; that is, the utility of the service in transporting an article of high value may be very small. Imagine two communities exactly alike in all of their facilities for production and also in their wants. None of the commodities produced by them, even the most valuable, could bear any charge for transportation.

the more it shall pay. This view of the matter is sound, so far as the variable expenses are concerned. If we could ignore the constant expenses, there would be no problem of the distance tariff. But it is apparent that it is possible to treat long-distance traffic as tho it were of low grade, it being relieved without economic loss of any contribution towards the constant expenses.

In the following diagram let us suppose that a commodity



is offered for shipment from stations A, B, C, D, and E to a market at O. Let the utility of the transportation service be OT in each case (that is, the maximum charge which the commodity could bear), and let ON be the variable station expenditures (loading and unloading), which are assumed to be the same for each station, and let the distance between MN and NP be the variable haulage expenses due to distance, which may be assumed to increase equally per mile. If there were no constant expenses, the total charge would vary as indicated by the line NM. The traffic from stations beyond D would be killed, and properly. To carry it would be a waste of effort. Now the constant expenses to be collected from this commodity may be distributed in a variety of ways.

If an attempt were made to impose them equally per unit of the commodity, we should have a total charge according to the line RS. The outer station would now be C. This results in a loss to the community as a whole to an extent represented by the area VWM, and would require the addition of the constant expenditures VSMW to the burden of the traffic from O to C. Thus such a plan of equal distribution of the constant expenditures would result in higher rates, since the traffic that was killed by this policy did bear at least part of the constant expense. We must, therefore, decide against the policy of an equal distribution of constant expenses between short and long distance traffic.

Again, the constant expenditures might be so imposed that the total charge would vary according to the broken line YWM, giving a uniform rate from O to C and an increasing rate from C to D. Here apparently is a justification for the group rate. Arbitrary as such a method of rate-making may seem, there would not be any objection to it from the standpoint of the maximum production of wealth, since it restricts no legitimate traffic. But there are also other methods of adjustment that will stand this test (for example, according to the line ZM in the diagram), so that the particular method to be adopted must take account of our notions of fairness or justice. Judging from current discussions and the practice of rate-making railroad commissions, a system of rates in which the total charge grows somewhat with the distance, with a decline in the rate per mile, would not be repugnant to prevailing ideas of justice, and, as has just been shown, such a system would meet the demands of a maximum production of wealth.

But it will be asked, How shall we determine how fast the rate per mile ought to decline with the distance? This need not be determined arbitrarily. Returning to the diagram, the slope of the line NM—that is, the increase in variable expenses as distance grows—is determined by technical conditions which must be ascertained as nearly as practicable. The distance MD (the utility of service)—that is, the maximum amount which a commodity can bear—is ascertained approximately by experiment or from past experience. The area ZNM—that is, the total contribution which this commodity may be called upon to make towards the constant expenses—is determined by the same considerations which are used in classifying commodities; namely, considerations as to what the traffic will bear, without involving questions of distance. Thus the same considerations which lead to the placing of coal in one class and silk in another would enable us to say what tax for defraying constant expenses may be levied on the coal traffic as a whole and what proportion of constant expenses should be borne by first-class traffic, etc. The area ZNM being determined, the distance OZ (the charge for the nearest station) is also determined, and the distance between ZM and OD indicates the charge for each separate station. All of this may seem ultra-theoretical, but, if the reasoning is accepted, the practical application is not complex. The rate of tapering should depart as little as possible from that indicated by the growth in variable expenses; that is, the charge for the longest distance being kept at the variable expense attributable to the long-distance shipments, the charge for the short-distance shipments being made only so high as is necessary to meet constant expenditure when the intermediate shipments are charged according to a simple progression between these two extremes.[1]

The total charge, then, would continually increase with the distance, but the ton-mile charge would grow less for two reasons: first, even if the general charges were imposed equally per ton, there would be a decline in the ton-mile charge, because the fraction

---

[1] It is true there is no good economic reason why in the diagram line ZM should be straight. It might be curved (see Launhardt, *Theorie der Tarifbildung*, Berlin, 1890, p. 60). The straight line satisfies current notions of justice.

$$\frac{\text{constant charge} + \text{station charge} + (\text{haulage rate} \times \text{miles})}{\text{miles}}$$

decreases as the miles increase. But, if this were the only decrease, there would be a restriction in the traffic, as has been shown; but in the plan proposed the constant charge also decreases with the distance until at the outermost station it is zero.

In the foregoing discussion it was assumed that the growing expense due to distance restricted the area over which the commodity could be transported. This may not be true with commodities for which the utility of the transportation service is high, and in this case a flat rate could be justified for any distance. In other words, the lower a commodity stands in the classification, the less justification there is for one rate, regardless of distance.[1]

M. O. LORENZ.

UNIVERSITY OF WISCONSIN.

---

[1] Several of the points here made are presented by E. Offenberg in the *Archiv für Eisenbahnwesen*, 1892, p. 1, to which the present writer did not have access until after the foregoing had been put in print.